# Induced Travel:

## Does Additional Highway Capacity Influence Travel Demand?

Presentation to Environmental Economics Advisory Committee of the Science Advisory Board
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USEPA

## Overview of Presentation

- What is Induced Travel? How is it defined?
- Why is Induced Travel Important to the EPA?
- Three Principal Questions for the SAB
- Induced Travel as Part of a Larger Research Program

## Definition of Induced Travel

- Increases in total vehicle miles of travel on a highway network resulting from increasing highway capacity, beyond that which results from:
  - (1) population growth
  - (2) changes in income
  - (3) other exogenous variables (demographic, auto ownership, etc.)

## Why is Induced Travel Important to the EPA?

## Three Principal Questions for the Science Advisory Board

- (1) Is the theory of induced travel from the provision of highway capacity consistent with economic theory?
- (2) Does the analytical methodology used in recent research test the hypothesis of induced travel?
- (3) Do the empirical results of the recent research support a conclusion that induced travel has historically occurred over the highway networks during the time periods studied?

# (1) Theoretical Statements on Travel Demand Elasticity

- "The Law of Peak-Hour Expressway Congestion" (Downs, 1962)
- "Triple Convergence" (Downs, 1992) from:
  - (a) alternative routes
  - (b) alternative time of day
  - (c) alternative modes of travel

# Induced travel reflects consumer responses to supply increases

- Short run effects
  - changes in departure times (no VMT increase)
  - changes in route (may be net VMT increase)
  - changes in travel mode
  - changes in destinations (net additional VMT)
  - increase in number of trips
- Long run effects:
  - changes in household auto ownership
  - choices regarding employment location
  - choices regarding residential location

# (2) Generalized Fixed Effects Model Complexities of Measuring Induced Travel Effects

- Potential multicollinearity:
  - VMT growth is also driven by demographic and other exogenous variables (e.g. women in workforce)
  - Multicollinearity may exist between independent variables (e.g. suburbanization and lane mileage)
  - Measuring lagged effect may increase complexity
- Possible simultaneity bias:
  - Anticipated VMT growth may influence decisions regarding capacity expansion
  - May result in inaccurate estimate of induced travel effect
  - Leads to debate about direction of causality

# Dealing with Multicollinearity

- Estimation results are robust across many model specifications
- The difference models produce comparable results as levels models

# Dealing with Simultaneity Bias

- Controlling for fixed effects reduces simultaneity bias in the

regression

- Granger causality test indicates that changes in lane miles precedes changes in vmt
- Using instrumental variables may more conclusively indicate direction of causality
  - many variables that affect LM also affect VMT
  - urbanized land area used as an instrumental variable

# Travel Demand Elasticities relative to Travel Time

## (3) VMT Elasticities relative to Lane Miles of Capacity

## Summary of Fixed Effects Models Research Findings

- Consistent positive correlation between Lane Miles of State Highways and VMT
- Fixed effects models allow consistent estimates of lane mile coefficients even with missing information
- Statistical methods attempt to minimize both multicollinearity and simultaneity bias
- Results are robust across many specifications

## Induced Travel as Part of a Larger Research Program

## Research Track 1a:

### Regional Traffic Flow Impacts

- Relationships between additional VMT and air quality impacts may be complex
- New highway capacity may influence the speed and flow characteristics of the traffic on existing highways:
  - average speeds
  - "stop and go" or smooth flowing traffic

## Research Track 1b:

### Regional Environmental Impacts

- Range of environmental impacts resulting from induced travel, including:
  - impacts upon air quality (e.g., criteria air pollutant and greenhouse gas emissions)
  - impacts upon water quality (e.g., the amount of stormwater runoff from highways)

## Research Track 2: Corridor/Project Specific Impacts

- Recent studies rely upon aggregate analysis of VMT at county, metropolitan, and state levels
- Corridor-specific and project-specific level research needed to empirically measure induced travel effects, resultant environmental impacts, and the conditions under which they occur